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Effect of Various Substrates on the Growth and Quality of Mushrooms

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Abstract: The effect of different biowastes such as paddy straw, sorghum straw, sugarcane molasses, saw dust and paper waste on the growth and biochemical constituents of oyster mushroom (*Pleurotus florida*) was studied. Favourable conditions were created to attain the maximum yield of mushrooms. The results reveled that mushroom growth was better in paddy straw followed by sugarcane molasses and least in wood saw dust and paper waste. The growth of mushrooms may be coincided with type of substrates used that leads to tremendous utilization of nutrients in the biowastes. The results further indicated that the biometric parameters such as fresh weight, dry weight and dry matter accumulation and biochemical constituents such as total sugars, protein, amino acids and lipids were also found to be higher in mushrooms grown in paddy straw followed by sugarcane molasses and least in wood saw dust and paper waste. The microelements such as phosphorous, potassium calcium and magnesium were also found to be higher in mushrooms grown in paddy straw when compared to the other substrates.

Key words: Mushrooms, *Pleurotus florida*, biowastes, biochemical constituents

INTRODUCTION

Mushrooms often called as Queen of vegetables and table delicious since time immemorial. Mushrooms are good source of proteins, amino acids and vitamins. Now-a-days the cultivation of mushroom is disseminated all over the world because of its revenue activity (Sreesakthi and Ponmurugan, 2006). Mushroom includes 1-6% of sugars, 20.3-42% of proteins, 0.5-3.5% of fats, mostly glycerides and glycolipids less frequently phospholipids, 0.5-1.5% of vitamin B2, vitamin D, E and K, but there is also consisting glycogen, mannitol, traces of sorbitol, arabitol and other microelements (Shukla *et al*., 2005; Nataraja *et al*., 2005).

The cultivation of oyster mushrooms is gaining importance in tropical and subtropical region due to its simple way of cultivation and high biological efficiency in paddy straw, which gave good yield than other substrates and useful for the degradation and recycle of biowastes (Singh *et al*., 1990). In India, paddy straw, cotton waste, coconut coir waste, sugarcane molasses and paper wastes are using for the cultivation of mushrooms (Geetha *et al*., 1994). The mostly cultivating *Pleurotus* sp. in India is *P. djamor*, *P. citrinopileatus*, *P. flabellatus*, *P. eous*, *P. oystereatus*, *P. sapidus*, *P.sajor-caju* and *P. Florida* (Suman and Sharma, 1990). In southern parts of India especially in Tamilnadu, the agricultural wastes are present in abundance. The present study was taken up to study the effect of various substrates available in local places on the growth and quality of mushrooms in terms of estimating biochemical constituents.

MATERIALS AND METHODS

The present study was conducted at School of Biotechnology, K.S. Rangasamy College of Technology, Tiruchengode, Namakkal District of Tamilnadu, India, for a period of one year (from May 2005 to May 2006). The oyster mushroom type *Pleurotus florida* is obtained from Tamilnadu Agricultural University, Coimbatore, Tamilnadu, India, for the present study. Four types of substrates *viz*., paddy straw, sorghum straw, sugarcane molasses, wood waste and paper waste were used for the cultivation of oyster mushrooms. In addition to that combination of different biowastes were also tested to obtain the maximal yield of mushrooms. These biosubstrates were chopped into 2-3 cm size of bits and sterilized using an autoclave (120°C at 15 psi). The sterilized materials were filled in a polythene bag (60×30 cm size) spread over with mushroom spawns.

The above prepared seed beds were kept in a room provided with a sufficient aeration, the temperature (24-30°C) and RH (80-100%) for spawn running. The beds were incubated for about 15-20 days. The mushrooms were harvested in the early morning before

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spraying water. The collected mushrooms were subjected to analyze the biometric parameters such as fresh, dry weight and dry matter content and biochemical parameters such as total sugars (Dubois *et al*., 1956), proteins (Lowrys *et al*., 1951), nitrogen (AOAC, 1990) and amino acids (Moore and Stein, 1948). The microelements such as phosphorous, potassium calcium and magnesium were estimated in the mushrooms according to the procedure of AOAC (1990) method.

RESULTS AND DISCUSSION

The fully flourished mushrooms were harvested on 23rd day from paddy straw, 18th day from sugarcane molasses and 17th day from sorghum straw and wood saw dust. Similarly, it was noted that mushrooms were harvested on 20th day from combination of biowastes (Table 1). The same trend was also observed by Shrama *et al*. (1981), Chakrabarthy and Shakar (1978). The emergence of mushrooms from the bed is purely based on the amount of cellulose present in the substrates (Sivaprakasam and Kandasamy, 1981). The yield in terms of fresh weight, dry weight and dry matter content was higher in paddy (268.94 g) and lower in wood saw dust (80.33 g). The combination of biowastes responded moderately in terms of growth of mushrooms.

The moisture content was found to be above 90% in mushrooms grown all the substrates, however, it was high in paddy straw, sorghum straw and sugarcane molasses (Table 2). The mushrooms fresh weight was 27.85 g and 22.85 g in paddy straw and sugarcane molasses, respectively. On the other hand, dry matter content was higher in wood saw dust that was recorded as 9.87% followed by combination of biowastes such as paddy straw with sugarcane molasses and sorghum straw.

The cellulosic substance will be degraded very easily by growing mushroom, whereas, non-cellulosic substances are not easily degraded. The degradable substances are used for their metabolic activities. The delayed harvesting were observed from the coir waste substrates, because the coir waste is one of the lignin substrates, it require long period for their decomposition. This observation is correlated with the work of Ramasamy *et al*. (1985).

Table 1: Effect of various substrates in harvesting period and total yield of mushrooms

Substrates used	No. of days	Yield (g)
Paddy straw	23	268.94
Sugarcane molasses	18	124.35
Sorghum straw	17	108.75
Wood saw dust	17	080.33
Paddy straw + Sugar cane bagasse	20	185.58
Paddy straw + Sorghum straw	20	177.26

There was a significant difference observed at 5% level in the biochemical constituents among the substrates (Table 3). However, all the biochemical constituents were higher in mushrooms grown in paddy straw followed by sugarcane molasses and sorghum and least in wood saw dust. The suitable protein contents were 33.33 and 28.38 mg g^{-1} of fresh weight of mushrooms grown in paddy straw and sugarcane molasses respectively. Similarly, total sugar content was 25.73 and 22.34 mg g^{-1} fresh weight of mushrooms grown in paddy straw and sugarcane molasses, respectively (Table 3). It is positively correlated with the earlier investigations of the Geetha *et al*. (1994) and Sangwan and Saini (1995). Increase in the yield of mushroom in paddy is due to easier way of getting of sugars from the cellulosic substrates. In the analysis of mushroom composition from various substrates, mushrooms from paddy straw gave high amount of proteins and amino acids. The mushrooms absorb the soluble sugar than the lignocellulosic substances and these sugars are used for their growth and other metabolic purposes. The excess sugar is under going secondary metabolism than that of growth (Nataraja *et al*., 2005).

Similarly, all the microelements such as phosphorous, potassium calcium and magnesium were also higher in mushrooms in paddy straw followed by sugarcane molasses and sorghum and least in wood saw dust (Table 4). However, it was moderate in mushrooms grown

Table 2: Effect of different substrates on the biometric parameters of mushroom

Substrates used	Fresh weight (g)	Dry weight (g)	Moisture content (%)	Dry matter content (%)
Paddy straw	27.85	1.85	93.35	6.64
Sugarcane molasses	22.85	1.54	93.26	6.73
Sorghum straw	18.23	1.22	93.31	6.69
Wood saw dust	11.35	1.12	90.13	9.87
Paddy straw + sugarcane molasses	19.74	1.66	91.59	8.41
Paddy straw + Sorghum straw	18.88	1.56	91.73	8.26
SE±	0.76	0.03	5.23	1.14
CD at p = 0.05	2.24	0.08	8.81	2.78

Table 3: Effect of different substrates on the biochemical parameters of mushroom

Substrate used	Total soluble proteins*	Total amino acids*	Total soluble sugars*	Total nitrogen*
Paddy straw	33.33	25.73	15.56	4.38
Sugarcane molasses	28.38	22.34	13.88	4.14
Sorghum straw	25.34	21.23	11.08	3.33
Wood saw dust	20.88	18.38	08.01	2.83
Paddy straw + sugarcane molasses	30.38	23.17	12.87	4.23
Paddy straw + + sorghum straw	27.23	21.85	12.00	3.89
SE±	1.56	2.03	4.23	1.15
CD at p = 0.05	4.26	4.24	4.45	2.56

* mg g^{-1} of fresh weight of mushrooms

Table 4: Effect of different substrates on the estimation of microelements in mushroom*

Substrates used	Phosphorous	Potassium	Calcium	Sodium	Magnesium
Paddy straw	134.82	379.33	3.50	83.72	4.62
Sugarcane molasses	130.26	366.36	3.23	80.23	4.23
Sorghum straw	128.44	356.67	2.83	78.84	3.83
Wood saw dust	114.82	323.22	1.55	70.45	3.08
Paddy straw + sugarcane molasses	130.53	371.40	3.02	80.08	4.30
Paddy straw + sorghum straw	259.56	370.29	3.00	80.23	4.00
SE±	7.89	9.03	1.22	5.15	1.06
CD at p = 0.05	24.56	54.20	2.45	22.56	1.45

* mg 100 g of sample

in mixed biosubstrates (paddy straw + sugarcane molasses and paddy straw + sorghum straw). These results were positively correlated with the work of Ramasamy *et al.* (1985). The present investigation reveals that al the cellulosic biowastes are effectively used as substrates for cultivation of mushrooms. The methods useful for cultivation of oyster mushrooms are very easy and it also protects the environment from the entry of biodegradable pollutant (Ansi and Raj, 1988, Krithiga *et al*., 2005). The mushroom cultivating techniques pave the way for the future food of human beings.

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